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ABSTRACT

This paper contains a description of the cross-over type of experimental design as well as a case study of its use in field testing audiovisual materials related to teaching handicapped children. Increased efficiency is an advantage of the cross-over design, while difficulty in selecting similar format audiovisual materials for field testing is a limitation. Types of research questions which can be answered by this type of design are discussed. A diagram of the cross-over technique and data tables from the case study are included. (STS)

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A CROSS-OVER EXPERIMENTAL DESIGN FOR TESTING AUDIOVISUAL TRAINING MATERIALS

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A CROSS-OVER EXPERIMENTAL DESIGN FOR TESTING AUDIOVISUAL TRAINING MATERIALS

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A problem that often faces developers of instructional audiovisual materials when they reach the "final" field-testing stage is the selection of a suitable experimental design. Many turn to Campbell and Stanley (1966) for inspiration and guidance. Of course, a number of more recent sources exist (e.g., Anderson, Ball & Murphy, 1975; Borich, 1974; Cooley, 1976; Glass, 1976; Popham, 1974; Struening & Guttentag, 1975; and Worthen & Sanders, 1973). This paper describes one design which is suitable in situations where a series of audiovisual materials is to be evaluated. This cross-over design is used to test audiovisual training packages in pairs.

THE CROSS-OVER DESIGN

Figure 1 shows the basic design. Two audiovisual training materials of identical format, but of unrelated content are tested together. Subjects are randomly assigned to either of the two materials. At the outset, subjects may not be aware that two different materials are being tested. After working through the material, subjects are given a posttest in which items related to the content of both materials are randomly interspersed. Subjects are informed that there are items in this composite criterion-referenced test which they may be able

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to answer as well as others they cannot. They are requested to answer as best they can. After an appropriate time delay, subjects go through the same process with the other material -- the one they did not previously experience. Again, the common posttest is administered.

In this very brief description of the design, a number of details have deliberately been omitted. An example of the application of the cross-over design a little later should fill in many of these.

WHAT QUESTIONS CAN BE ANSWERED BY THIS DESIGN?

With modifications and variations, the design permits a variety of questions to be answered. In its basic form, four major questions may be resolved:

1. Do subjects learn from the material?

   Aa > Ba
   Bb > Ab

2. Is what is learned from the material retained over time?

   Aa = ABa
   Bb = BAb

3. Does the order in which subjects work through the two materials have an effect on learning?

   ABab = BAab

4. Does pretesting have any effect on learning from the material?

   Aa = aAa
   Bb = bBb

By inserting instruments to collect attitudinal data, the same

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four questions may be raised in terms of subjects' attitudes.

THE CROSS-OVER DESIGN ILLUSTRATED

The Center for Innovation in Teaching the Handicapped at Indiana University produces many audiovisual training packages for training teachers of exceptional children. All of the training materials must undergo final, carefully controlled field-testing. Applying the cross-over design, two of their audiovisual training packages, Parents as Partners in Teaching the Handicapped (PAP) and Instructional Games for Handicapped Children (IG) were selected by a jury as a suitable testing pair. Both are virtually identical in format (filmstrip, synchronized audiocassette, response book), yet extremely different in content -- PAP is on setting up parent-tutoring programmes; IG provides a step by step procedure for designing and running games.

From a pool of potential sites, four were randomly selected. For logistical reasons, one was dropped, leaving three: Atlanta, Georgia, Asheville, N.C. and Cullowhee, N.C. Subjects at these sites represented the ultimate users of the packages, namely pre-service and in-service special education teachers. Table 1 offers some background information on the subjects.

At each site, Singer Auto-Vance II synchronized filmstrip viewers were set up. By coin flip, subjects were assigned to one of the two packages. A technician started up the machines. Subjects proceeded through the materials according to printed and audio directions. At the end of the package, subjects answered content

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and attitude questionnaires related to both materials. Since all subjects were either enrolled in a practicum or were practising teachers, the possibility of cross contamination was reduced. Three weeks later, subjects went through the same process except that this time they worked through the material they had not previously seen.

Tables 2, 3, 4, and 5 summarize the results. Using the cross over design, the following questions were answered within the limitations of the study:

1. Students learn from PAP and from IG.
2. There is a significant decline in retention after three weeks.
3. Order of presentation does not affect results.
4. Pretesting has no significant effects on learning.
5. Attitudes towards PAP are improved through use of the package. This is not so in the case of IG.
6. Attitude gains are maintained over time.

ADVANTAGES AND DISADVANTAGES OF THE CROSS-OVER DESIGN

Several advantages accrue to the use of this design:

1. Two materials are tested at a time.
2. Subjects are not "wasted" due to assignment to a control group. Each group acts as a control for the other.
3. A large number of extraneous variables are controlled. The only difference between the groups is the content of the materials which is what we are evaluating.
4. Several important questions can be answered through application of the design such as retention over time and effect of pretest.
5. Instruction is never withheld from any subject.

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6. The initial phase before crossover avoids pretest contamination.

The design is not without its disadvantages:

1. Materials must be identical in format and dissimilar in content.

2. Subjects become fatigued and frustrated from excessive testing, especially as they are forced to answer questions which appear to be irrelevant.

3. It is difficult to control for cross contamination during the delay between the treatments.

4. Payoff evaluation is not included in the design.

A FINAL NOTE

All designs possess strengths and weaknesses. This particular design appears to be especially efficient. It does require two treatments for each group which may result in experimental mortality. Randomization is essential. Test reactivity may confound some of the results. Negative attitudes towards tests may affect content attitude scales. Anonymity and confidentiality of results for subjects must be guarenteed. Within all these limitations, however, the design does offer a very useful tool for evaluating audiovisual training materials.

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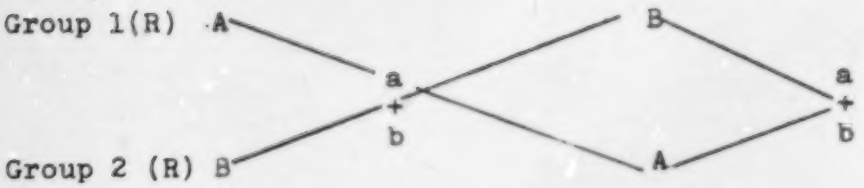

A = audiovisual training material 1

B = audiovisual training material 2

a = posttest items for audiovisual training material 1

b = posttest items for audiovisual training material 2

R = random assignment of subjects to materials

Figure 1. The cross-over design

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Table 1

Frequency of Subjects in Terms of Age, Teaching Experience with Handicapped Children, Level of Education, and Number of Special Education Quarter Courses Taken

(N = 90 Subjects)

Age	f	Age	f
19-21	48	31-33	1
22-24	19	34-36	3
25-27	8	37-39	1
28-30	5	40+	5

Teaching Experience	f	Teaching Experience	f
None	49	3-5 years	2
Less than 1 year	29	6-10 years	2
1-2 years	8		

Education Level	f	Education Level	f
Freshman	2	Senior	40
Sophomore	2	Master's student	19
Junior	25	Master's degree	2

Number of Special Education Courses Taken	f	Number of Special Education Courses Taken	f
1	11	5	8
2	10	6-10	33
3	4	11-15	11
4	8	16-20	5

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Table 2

Means and Standard Deviations of Scores on the Criterion-Referenced Test on Parent-Tutoring

	Test Administration I		Test Administration II	
	Mean	Standard Deviation	Mean	Standard Deviation
Group[a]				
A	41.69	6.70	37.33	8.30
B	21.69	10.32	40.04	9.21

[a] n = 45 for each group

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Table 3

Means and Standard Deviations of Scores on the Criterion-Referenced Test on Instructional Games

Group[a]	Test Administration I		Test Administration II	
	Mean	Standard Deviation	Mean	Standard Deviation
A	23.51	4.25	33.42	4.31
B	34.40	5.11	29.78	4.30

[a] n = 45 for each group

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Table 4

Means and Standard Deviations of Attitude Scores Toward Parent-Tutoring

	Test Administration I		Test Administration II	
	Mean	Standard Deviation	Mean	Standard Deviation
Group[a]				
A	79.42	8.58	78.53	6.37
B	73.80	8.07	80.44	7.23

[a] n = 45 for each group

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Table 5

Means and Standard Deviations of Attitude Scores Toward Instructional Games

Group[a]	Test Administration I		Test Administration II	
	Mean	Standard Deviation	Mean	Standard Deviation
A	81.91	15.09	85.27	9.15
B	85.20	8.48	83.51	10.83

[a] n = 45 for each group

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